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7.6-10445  
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LANDSAT Follow - On Investigation Program #21260

Program Progress Report #3

Reporting Period Coverage: March 19, 1976  
June 19, 1976

Submitted by: Ira S. Latimer, Jr.  
Project Principal Investigation

Date Submitted:

(E76-10445) CONTRIBUTION OF ERTS-B TO  
NATURAL RESOURCE PROTECTION AND RECREATIONAL  
DEVELOPMENT IN WEST VIRGINIA Progress  
Report, 19 Mar. - 19 Jun. 1976 (West  
Virginia Dept. of Natural Resources) 18 p G3/43

N76-29675  
HC \$3.50

Unclas  
00445



STATE OF WEST VIRGINIA  
DEPARTMENT OF NATURAL RESOURCES  
CHARLESTON 25306

IRA S. LATIMER, Jr.  
Director

NASA Scientific and Technical  
Information Facility  
Post Office Box 33  
College Park, Maryland 20740

Attention: Earth Resources

Subject: The third LANDSAT Follow-On Investigation  
Program #21260 Progress Report

Enclosed is a copy of the third Progress Report  
covering the reporting period from March 19, 1976--June 19,  
1976.

If you have any questions or desire additional  
information, do not hesitate to contact this office.

A handwritten signature in dark ink, reading "Ira S. Latimer, Jr.", with a stylized flourish at the end.

Ira S. Latimer, Jr.  
Principal Investigator *ento*

ISL/mlk

CONTRIBUTION OF EARTH TO NATURAL  
RESOURCE PROTECTION AND  
RECREATIONAL DEVELOPMENT IN  
WEST VIRGINIA



STATE OF WEST VIRGINIA  
DEPARTMENT OF NATURAL RESOURCES  
CHARLESTON 25305

IRA S. LATIMER, Jr.  
Director

Receiving Officer  
Building 16  
Goddard Space Flight Center  
Greenbelt, Maryland 20771

Attention: Code 902.6

Subject: The third LANDSAT Follow-On Investigation  
Program #21260 Progress Report

Enclosed are nine (9) copies of the third Progress  
Report covering the reporting period from March 19, 1976--  
June 19, 1976.

If you have any questions or desire additional  
information do not hesitate to contact this office.

A handwritten signature in cursive script, reading "Ira S. Latimer, Jr.", is positioned above a horizontal line.

Ira S. Latimer, Jr.  
Principal Investigator

ISL/mlk

07



STATE OF WEST VIRGINIA  
DEPARTMENT OF NATURAL RESOURCES  
CHARLESTON 25305

IRA S. LATIMER, Jr.  
Director

MEMORANDUM TO: Ira S. Latimer, Jr.  
Director

FROM: Michael Luke  
LANDSAT Program Coordinator

SUBJECT: The LANDSAT Program  
Progress Reports

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NASA has requested the third progress report for the LANDSAT Program involving the time period from March 19, 1976 to June 19, 1976. These reports will be made every three months during the period of performance part of the project. Some of the technical guidance for the reports are coming from the Earth Satellite Corporation.

GML/jmk

Enclosure

21260

RECEIVED

JUL 30 1976

SIS/902.6

## I. Problems

No significant problems occurred during the fourth time period. The program's primary projects have been outlined and each one has been started in one form or another.

## II. Accomplishments and Significant Results

The LANDSAT Program has two main categories for the projects which will be done during this contract.

The first category involves the primary projects which will basically be done by the Earth Satellite Corporation. The satellite imagery will be used more with these, because of the expertise required to interpret the details necessary to make the project's information useful.

The secondary category has all the projects that the Department of Natural Resources will do or sponsor to be done by graduate students or other agencies. These projects represent the start of the Department's objective to develop a team of remote sensing technicians who will work on "interpretive" projects for the different divisions of the DNR.

At the present time the Department of Natural Resources is cooperating or sponsoring five graduate students to do research for either Master's or Doctor's Degrees, using remote sensing techniques as an inventory tool. Most of the projects concern forest vegetation cover type studies of state parks or forests.

### A. Primary Projects

#### 1. A Satellite Image Photomosaic of West Virginia

This project is designed to use 1973 LANDSAT Imagery to construct a color composite photomosaic of West Virginia. The basic mosaic has been made and preliminary interpretations have begun. Some of the delineations which have started include: a) State boundaries, b) latitude-longitude coordinates, c) cultural information, d) preliminary ecozones, e) a classification system for interpreted information. The mosaic should be finished within 6 weeks.

Plans are now being made to utilize the photomosaic product as a resource data base for at least three state agencies. These agencies or divisions of agencies will hopefully utilize the mosaic product in

forms of educational literature for the public.

A proposal is being organized to present to the West Virginia Department of Commerce, concerning ways in which the photomosaic can be used as a base map for types of information such as: a) travel brochures, b) specific interest brochures, c) industrial development study information, d) educational posters and charts.

Another proposal will be submitted to the DNR for the utilization of satellite imagery and U-2 photography for information brochures and posters concerning state parks and forests. The brochures should contain color composite or color infrared pictures with important features outlined.

The West Virginia University Forestry School is doing a project concerning a "Forest Atlas" of West Virginia. The photomosaic color composite will also be used in various ways for this study.

## 2. The Wetlands Classification Project

The EarthSat Company has gathered information from the DNR concerning the location of the wetlands in Harrison County. The DNR wetland information was presented on topographical quad sheets.

The average area of a wetland in West Virginia is less than five acres. This necessitates the need for using the U-2 color infrared photography for the interpretation. Wetlands have been delineated from U-2 photography in the Canaan Valley Area of Tucker County. This information will be used to help locate additional ones. A field trip is scheduled within the next two weeks to survey some existing wetlands from a low flying airplane. The total wetlands project should be finished in six weeks.

## 3. The Forest Vegetation Cover Type Project

Summer and early fall imagery from the "Pocohontas County" frame of satellite imagery is being used to delineate the five different forest vegetation cover types within the region south of Clarksburg, West Virginia.

At the present time background literature concerning forest cover types is being reviewed and the imagery to be used for the project will be used in the West Virginia "Forest Atlas" which is being organized by West Virginia University.

4. The Canaan Valley - Dolly Sods Project

This project now has three main objectives which are: a) to provide ecological information for the naturalist programs at Blackwater Falls and Canaan Valley State Parks, b) to provide information about a wilderness area including Dolly Sods, which is being considered for purchase as a preserved natural area, and c) to provide valuable ecological information about the "natural significants" of the Canaan Valley Area.

The completion of the interpretive phase of the project is dependent upon the accuracy of the delineations made from the U-2 CIR photography. The accuracy will be checked by the use of aerial survey work from a low flying airplane, comparison of reference information about the area, and ground truth information. A field trip is planned for the week of June 21st to varify the accuracy of the work that has been done.

The satelllite imagery will be used to show regional considerations of the area at a scale of 1:250,000 such as ecozones, cities, water bodies, and unique natural features.

5. The Remote Sensing Workshops

The majority of the time involved in the last three months of the program was spent in organizing and conducting the two remote sensing workshops which were held in Morgantown, (May 10-14), and Charleston, West Virginia, (May 24-28, 1976).

Each workshop was designed to complete the following objectives:

- A. Providing potential users of remote sensing imagery for environmental considerations with a basic knowledge of applications and limitations.



- B. To bring together personnel from diverse governmental and private sectors for exchange of information and techniques which can be applied to current needs.
- C. To expand the remote sensing users knowledge of remote sensing imagery as a tool in natural resource assessment and management.
- D. To give the participants references of some of the types of remote sensing information available and an idea of the past, present, or future projects which might involve the usage of some type of remote sensing data in West Virginia and the surrounding area.

The participants of the workshops were from various government agencies, colleges and universities, and private businesses concerned with the use of natural resources. The majority of the attendants were technical type people who should be directly involved with the use of remote sensing.

Their educational backgrounds varied from engineering and teaching, to forestry and landscape architecture. With such a variety of participants, the workshop presentations had to be introduced at an intermediate level.

It is a possibility that additional remote sensing workshops can be held in the future. The interest for these workshops will develop more, as the LANDSAT Program progresses.

#### 6. Strip Mine Inventory Project

There is a growing interest in the State concerning digital and computer analysis systems capabilities for land use projects. The State is rapidly changing due to industrial, and natural resource development. It is very important that this development be "monitored" effectively for decision making purposes.

Since the issue of surface mining is of prime importance to the development of West Virginia, this project has been re-organized to demonstrate digital

analysis techniques for LANDSAT Imagery. It is hoped that this type of capability can be injected into the regulatory system of strip mine development in the State.

The Strip Mine Inventory Project is scheduled to be done the last week of July, 1976, using the General Electric Image 100, or the Bendix Digital Analysis System for the processing of the computer compatible tapes. The "interest area" for the project will be McDowell County which is located along the border of southern West Virginia.

This project will directly involve a representative of the DNR for the purpose of learning how to do the analysis.

The classification system for information obtained from the tapes will include such things as:

- a. Area estimates of the strip mines,
- b. Location of the mines,
- c. A category classification designating:
  - (1) an active mine,
  - (2) a finished and reclaimed mine,
  - (3) an unreclaimed and abandoned mine.

Imagery and reference information is being gathered concerning the conditions of the strip mines in McDowell County for the time period from July - December of 1975.

#### 7. The Coal Refuse and Dam Control Project

This project will work in conjunction with the strip mine inventory project. The McDowell County area imagery will be digitally analyzed to determine such things as:

- a. The location of the water impoundments,
- b. The area of the impoundments,
- c. The vegetative conditions surrounding the impoundments.

The results of the digital analysis will be compared with the results from the manual interpretation of other forms of imagery, such as CIR U-2 photography, to determine technique capabilities and differences.

## 8. An Ecological Interpretation Project

The representatives from the U. S. Fish and Wildlife Service have started to organize the materials and techniques to be used for the ecological interpretation of existing or proposed water impoundment projects in West Virginia. Remote sensing techniques and ground truth information will be used to inventory the 3-10 thousand acre sites. Some of the interpretive techniques and capabilities which were discussed at the Morgantown Remote Sensing Workshop can be used for the inventories.

The imagery to be used for the projects will include ASCS black and white photography, SCS black and white photography, U-2 CIR photography, low altitude color photography, satellite color composites at 1:250,000 scale, and possibly low altitude CIR photography.

A demonstration project has been preliminarily outlined to show capabilities of CIR U-2 photography and satellite imagery. The interpreted information will be displayed on a CIR photography overlay map and a satellite enhancement at 1:250,000 scale.

If the Fish and Wildlife Service can organize and develop their own remote sensing inventory capabilities, then the LANDSAT Program will de-emphasize the proposed demonstration project and shift more emphasis to a different application.

## B. Secondary Projects

### 1. Blackwater Falls State Park

This project involves the use of color photography, color infrared aerial photography, and satellite imagery to inventory a defined region including Blackwater Falls State Park.

The primary interpretation of the 1:24,000 CIR photograph has been completed and is being used in the park's naturalist program. The photographic overlay product and color slides have been used in a training session which was held for all the naturalists working at State facilities. The presentations

at the naturalist's training session included information concerning satellite imagery, color infrared photography, basic remote sensing inventory techniques of natural resources using different types of imagery, and vegetative mapping procedures. The naturalists seemed very enthusiastic about the possibility of using remote sensing imagery and techniques in their programs.

The Department of Natural Resources believes that the educational concepts concerning ecology and conservation can be "effectively" taught in the State parks and forest facilities. The use of remote sensing techniques and applications could possibly revolutionize these interpretive programs.

## 2. State Parks

Other State Parks and Forests that will be studied this year include: Babcock, Watoga, Pipestem, Lost River, Holly River, and North Bend State Parks. Along with Cooper's Rock, Greenbrier, and Kanawha State Forests.

## 3. Cooperation With The West Virginia Nature Conservancy Project

The Nature Conservancy Project is inventorying unique ecological areas in West Virginia. The results from this study will be organized into a computerized resource data base.

The classification system that the Conservancy is using has been reviewed and considered for use with the LANDSAT Program results. Modifications will have to be made, but the LANDSAT resources data will be computerized so that agencies in the State will be able to use it more effectively.

The primary reason for not setting up a classification system at this phase of the LANDSAT Program has been because the research projects have not developed to the point of demonstrating the variety of information which will be received as results of the projects.

## 4. Overlay Maps

The Department of Natural Resources is currently doing overlay maps on satellite color composite

images at 1:500,000 scale of the Eastern Central Mountainous Section of the State. These overlays will contain information such as: county boundaries, major cities, major water bodies, unique natural areas, and vegetation cover type zones. The county boundary overlay is the only one that is finished.

#### 5. Public Relations Projects

- a. Articles have been put in 14 newspapers throughout the State announcing the establishment of the LANDSAT Program.
- b. An article was published in the June issue of the "Wonderful West Virginia Magazine" concerning the LANDSAT Program and the use of color infrared high altitude photography. (Enclosures)
- c. Public relations presentations have been made to various groups in the State.

#### 6. Slide Programs

The Department of Natural Resources is currently organizing two slide-video cassette tape programs which will be available in the Department of Natural Resources Library for use by DNR personnel and other State agencies.

- a. Infrared Photography - (20-30 minutes - 50% completed)

This slide program will explain the principles, techniques, and applications of infrared photography. The program should be completed by August, 1976.

- b. The West Virginia LANDSAT Program - (20-30 minutes - 50% completed)

This presentation will explain the objectives of the West Virginia Program and give basic information on some of the work being done in other areas of the country.

#### 7. Color Infrared High Altitude Photography Coverage of the State

CIR photography taken in December, 1973, has

been recieved by the DNR. This imagery, which is available to other agencies, will provide coverage for most of the State on 1:120,000 scale. Some of the 9" X 9" transparencies and 35mm sectional slides of the U-2 frames are being used for vegetation studies.

## 8. Potential Secondary Projects

### a. An Inventory of Cooper's Rock State Forest

The project has been approved and will follow the enclosed outline.

### b. A Turkey Habitat Study

The Wildlife Division of the DNR is currently involved with a research project using telemetry methods to monitor the activities of wild turkeys in Pocohontas County, West Virginia.

The LANDSAT Program hopes to use CIR photography to determine the natural conditions of the areas inhabited by the turkeys. This information will give the biologist a better idea of the natural environment of West Virginia's most challenging game bird.

### c. Using Aerial Photography and Satellite Imagery for Displays of Information Presented by the West Virginia Department of Commerce

The DNR is currently gathering information and organizing a proposal to be presented to the Commerce Department for utilizing imagery for displaying important information in travel brochures, state park directories, and on outline maps and charts.

## III. Publications

No publications have been made at this time.

## IV. Recommendations

No program recommendations can be made at this time.

## PROJECT AT COOPER'S ROCK STATE FOREST

INTRODUCTION

West Virginia's state forests are very important to the people of West Virginia and visitors that come to the "Mountain State." They serve in a multiple-use capacity of the natural resources which include the following:

1. The management and improvement of habitat for fish and game.
2. The demonstration of growing trees for timber in compatibility with other uses made of the area.
3. The harvesting of timber which can be used in many products.
4. The protection of watersheds and water quality.
5. The management of outdoor recreation without conflict to other uses.
6. The aesthetic value of the woodlands.

Thus, their value to future generations is multitudinous. The multiple resource management areas can provide another very important service to the public by acting as ecology and conservation education centers.

The need for modified ecological interpretation programs in these facilities throughout West Virginia has created an interest in using color aerial photography and satellite imagery to explain the different environmental considerations involved within a forest and the surrounding areas. The satellite imagery can be used to explain regional environmental considerations with aircraft imagery providing added detail.

### PROJECT DEVELOPMENT STAGES

1. Use satellite imagery to interpret the important environmental considerations within the boundaries of Cooper's Rock State Forest as well as the surrounding regional area.
2. Use color infrared aerial photography to gather more detail about the ecological interest areas interpreted from the satellite imagery.
3. Classify the information and organize it into categories which may be used as educational information for the public.
4. After the different interest areas have been established, arrange the material to show how each area is important to the total regional ecological system.
5. Establish an information center at Cooper's Rock to explain the important aspects of regional ecology which would be displayed on aerial photographs accompanied by some type of explanatory information.

### METHODS OF OBTAINING INTERPRETIVE INFORMATION

- A. Use Satellite imagery
- B. Use aerial photography
- C. Gather information about the area from local authorities and available reference material.
- D. Ground survey work.

### PARTICIPANTS INVOLVED IN ORGANIZING THE PROJECT

- A. Forestry Division people from DNR
  1. Superintendent of Cooper's Rock State Forest - Bennell White
  2. District Forester - Lowell McPherson
  3. Assistant State Forester - John Merna



- B. A LANDSAT Program representative
- C. W. V. U. ecology experts
  - 1. Dr. Baer                      3. Bill Wylie
  - 2. Dr. Carvell                4. Dr. Core
- D. Two graduate students from W. V. U. Forestry School

SOURCES OF MONETARY OR SERVICE SUPPORT FOR THE PROJECT

- A. Department of Natural Resources
  - 1. LANDSAT Program - This program will donate such things as color infrared aerial photography, satellite imagery and technical assistance in training the project participants.
  - 2. Forestry Division - The Forestry Division could provide the Superintendent of Cooper's Rock State Forest and the District Forester as consultants for the project, and sponsor the displays consisting of glass and wooden cases which will be utilized to show the public the interpretive material.

B. West Virginia University

The Forestry School at W. V. U. will sponsor two graduate students to work on the project. Also the consulting professors from the University will donate their time to provide information about the study area.

Completion date for the project - October - December of 1977.

9-4  
REMOTE SENSING WORKSHOP  
Registration List  
May 24-28, 1976  
CHARLESTON

Jean Anderson  
WV Heritage Trust Program  
1116 Quarrier Street  
Charleston, WV 25301

Michael Annand  
DNR - Planning & Development  
1800 Washington Street East  
Charleston, WV 25305

James D. Ashworth  
Sanitary Engineer  
U. S. Army Corps of Engineers  
P. O. Box 2127  
Huntington, WV 25713

Thomas W. Curtis  
Regional Dev. Specialist  
Appalachian Dev. Office  
M-156 State Capitol  
Charleston, WV 25305

Dan K. Evans  
Assistant Professor - Biology  
Biology Department  
Marshall University  
Huntington, WV 25701

James E. Gilley  
U. S. Bureau of Mines Liaison Office  
P. O. Box 428  
Charleston, WV 25322

Richard D. Horn  
Dept. of Natural Resources  
Coal Refuse & Dam Control  
209 Maplewood Lane  
Beckley, WV

Steven J. Knopp  
Planner  
WVDNR - Water Resources Division  
1201 Greenbrier Street  
Charleston, WV 25311

Charles M. Murphy  
Graduate Student  
Marshall University  
P. O. Box 251  
Milton, WV 25541

Franklin B. Pelurie  
Field Coordinator  
The Nature Conservancy  
1116 Quarrier Street  
Charleston, WV 25301

James W. Rawson  
DNR - Wildlife Resources  
P. O. Box 67  
Elkins, WV 26241

James M. Ruckel  
DNR - Wildlife Resources  
1800 Washington Street East  
Charleston, WV 25305

Arnold F. Shulz  
Forest Wildlife Biologist  
U. S. Forest Service  
Monongahela National Forest  
Box 1231 Sycamore Street  
Elkins, WV 26241

Leslie E. Terry  
U. S. Fish & Wildlife  
Division of Game Services  
P. O. Box 67  
Elkins, WV 26241

Randy Underwood  
DNR - Coal Refuse & Dam Control  
312 Main Ave.  
Nitro, WV 25143

Harold Ward  
Professor  
Biology Department  
Marshall University  
Huntington, WV 25701

Dave Winger  
Associate Professor - Biology  
Parkersburg Community College  
Route #5, Box 167-A  
Parkersburg, WV 26101

9-5

REMOTE SENSING IMAGERY WORKSHOP

Registration List

May 10-14, 1976

Christopher M. Clower  
Rishery Biologist  
U. S. Fish & Wildlife Service  
P. O. Box 346  
Elkins, West Virginia

Mark W. Cook  
Research Technician  
Division of Forestry  
West Virginia University  
WVU Forest Headquarters  
RD 1 Box 269  
Bruceton Mills, West Virginia  
26525

Fairy Downs  
Co. Ext. Agent, 4-H  
WVU Extension  
Box 1628  
Fairmont, West Virginia 26554

Brian Easterday  
1302 Chestnut Hill Apt.  
Morgantown, West Virginia  
26505

Harvey E. Fleming  
Forester  
U. S. F. S.  
1106 South Kerns Avenue  
Elkins, West Virginia 26241

Terry L. Fleming  
WV Dept. of Natural Resources  
180 Canfield Street  
Morgantown, West Virginia 26505

David B. Harris  
U. S. Fish & Wildlife Service  
P. O. Box 346  
Elkins, West Virginia 26241

Shawn G. Head  
Biologist  
Dept. of Natural Resources  
Wildlife Division  
1304 Goose Run Road  
Fairmont, West Virginia 26554

Gene Hundley  
Land Management Forester  
Gauley Woodlands  
Westvaco Corporation  
Box 577  
Rupert, West Virginia 25984

Jack A. Kemerer  
Upshur County Schools  
Route 1 Box 360  
Buckhannon, West Virginia 26201

Kenneth Orndorff  
Graduate Assistant  
West Virginia University  
601 Grant Avenue  
Morgantown, West Virginia 26505 (HOME)

Dale Pike  
DNR WV Heritage Trust Program  
1116 Quarrier Street  
Charleston, West Virginia 25301

James P. Reger  
Graduate Student  
Department of Geology & Geography  
West Virginia University  
Morgantown, West Virginia 26506

Jerry P. Simmons  
USDA Soil Conservation Service  
114 Apolla Drive  
Morgantown, West Virginia 26505

Ellen R. Snyder  
Student  
Department of Geology  
West Virginia University  
315 Ridge Avenue  
Washington, PA 15301 (HOME)

Greg Stamm  
College of Agriculture & Forestry  
West Virginia University  
Route 4 Box 387  
Mountaineer Trailer Park  
Morgantown, West Virginia 26505

David A. Steffy  
Grad Student - Geology  
West Virginia University  
1495 B North Willey ST.  
Morgantown, West Virginia 26505 (HOME)

Ron Sturm  
Grad Student - Ecology  
West Virginia University  
Dept. of Biology  
Morgantown, West Virginia 26505

9-6

William Tolin  
Wildlife Biologist  
U. S. Fish & Wildlife Service  
Ecological Services  
P. O. Box 346  
Elkins, West Virginia 26241

Robert W. Wirgau  
Executive Director  
BHJ Metropolitan Planning Commission  
814 Adams Street  
Bloomindale, Ohio 43952

Gary W. Zinn  
Assistant Professor  
Division of Forestry  
West Virginia University  
325 Percival Hall  
Morgantown, West Virginia 26506

ORIGINAL PAGE IS  
OF POOR QUALITY

Friday

9:00-10:30 am.

The Land Use Data and  
Analysis Program of  
West Virginia  
(S. Hoerning)

10:30- 3:30 pm.

Field Trip  
(Arrangements will be  
made for lunch. A  
comparison of imagery  
with on-site features  
including geologic  
soils, surface mining,  
vegetative cover, and  
land use.

#### INVITED SPEAKERS

Arthur T. Anderson, Staff Scientist  
Earth Resources Branch  
National Aeronautics and Space Administration  
Dan Richards  
User Affairs  
National Aeronautics and Space Administration

#### WORKSHOP COMMITTEE MEMBERS

Charles Baer - Professor of Biology: Biology Depart-  
ment, West Virginia University  
Kenneth A. Curran - Professor of Silviculture  
Forestry School, West Virginia University  
Ronald A. Eck - Assistant Professor of Civil Engi-  
neering, West Virginia University  
Michael Luke - LANDSAT Program Coordinator, West  
Virginia Department of Natural Resources  
Kenton Schmale - State Soil Scientist, USDA, Soil  
Conservation Service  
Robert G. Shuman - Professor of Zoology and Ge-  
ography, West Virginia University  
Edward W. Turner - Research Assistant, Department of  
Biology and Geography, West Virginia University  
Judy W. Hoerning - Environmental Scientist, West  
Virginia Department of Natural Resources

#### WORKSHOP COORDINATORS

Charles Baer  
Biology Department  
West Virginia University  
Morgantown, West Virginia 26505

Michael Luke  
Department of Natural Resources  
Research and Statistics  
1000 Washington Street, East  
Charleston, West Virginia 25305

#### SPONSORING AGENCIES

West Virginia Department of Natural Resources  
West Virginia University

#### COOPERATING AGENCIES

National Aeronautics and Space Administration  
The West Virginia Geological and Economic Survey  
The United States Department of Agriculture,  
Soil Conservation Service  
West Virginia University Foundation  
Division of Off Campus Credit Programs (WVU)

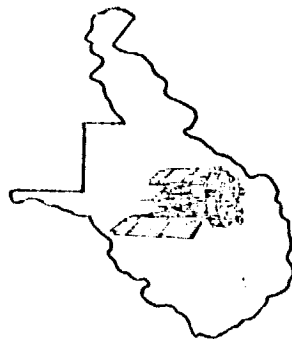
#### INFORMATION RESOURCES

Aerial Photography Interpretation, Avery, 1968.  
Aerial Photography in Ecologic Interpretation and  
Mapping, A. C. Kay, USGS Professional Paper 373,  
Bureau of Color Aerial Photography, American Society  
of Photogrammetry, 1961.  
Manual of Remote Sensing, American Society of Photo-  
grammetry, 1975.  
Vegetation Mapping, A. W. Knuckler, 1967.

\*Each workshop participant accepted will receive  
a publication. Due to the limited room in each  
workshop, there will be only 12-15 participants  
accepted after April 26, 1976.

#### THE WEST VIRGINIA LANDSAT REMOTE SENSING WORKSHOPS

1976



Morgantown, May 10-14  
WVU

Charleston, May 24-28  
DNR

\* Registration before April 26 - \$15.00  
after April 26 - \$20.00

#### GENERAL DESCRIPTION

This WORKSHOP will deal with an up-to-date  
summary of remote sensing techniques, the current  
methods of producing useful read-outs in the forms  
of map overlays and quantitative parameters of  
surface features of various natural resources elements.  
At least half the time will be devoted to guided  
laboratory and field experience in interpretation  
of aerial photography and computerized imagery of  
West Virginia's surface. The participants should  
gain a working knowledge for obtaining suitable  
imagery and putting it to use in meeting the State's  
needs for coordinated resource inventories and  
conservative utilization for maximum benefits.  
Perhaps the most valuable outcome of this first  
West Virginia Remote Sensing Workshop will be the  
interaction of those using remote sensing with  
those who could be using remote sensing imagery.

Location of Workshops

May 10-14, 1976

West Virginia University  
Percival HallRoom 317  
Morgantown, West Virginia 25605

May 24-28, 1975

Conference Center  
Building C, Room C  
1900 Washington Street, East  
Charleston, West Virginia 25305HousingHoliday Inn  
Monongalia Boulevard  
Morgantown, West Virginia  
Phone: 304-292-1680Lakeview Inn and Country Club  
N. Va. Route 7 at Great Lake  
Morgantown, West Virginia  
Phone: 304-292-0401Heart O'Town Motor Inn  
Broad and Washington Streets  
Charleston, West Virginia 25301Holiday Inn #2  
600 Kanawha Boulevard, East  
Charleston, West Virginia 25302  
Phone: 304-344-4092Workbook

A workbook containing a schedule of the program along with reference materials and other accessories will be distributed.

Handbook

A Remote Sensing Handbook containing copies of the lecture materials, aerial photos, and other reference information will be distributed after the workshop. These handbooks will provide background information on remote sensing projects.

Creditation

Those wishing to obtain one hour University credit, should contact Dr. Baer for registration instructions with West Virginia University.

WORKSHOP PROGRAMMonday

8:00-10:00 am.

Registration

10:00-10:30 am.

Welcome and Announcements  
(Ira S. Latimer, Jr.)  
(Director DHR)

10:30-12:00 am.

An Introduction to Remote  
Sensing of Natural Resources  
(R. Macomber)

12:00- 1:30 pm.

Lunch

1:30- 3:30 pm.

Introduction to Remote  
Sensing Lab

3:30- 4:30 pm.

Satellite and Aerial  
Imagery of West Virginia  
(S. Woodring)

6:00- 8:30 pm.

Dinner and Guest Speaker  
(Dan Richards)  
(NASA)Tuesday

9:00-10:00 am.

Production of Orthophoto  
Maps  
(USGS)

10:00-11:00 am.

Lab

11:00-12:00 am.

Interpretation of  
Geological Features  
from Imagery  
(Eb Werner)

12:00- 1:30 pm.

Lunch

1:30- 2:30 pm.

Geology Lab

Tuesday (cont.)

2:30- 3:30 pm.

Civil Engineering  
Applications  
(R. Eck)

3:30- 4:30 pm.

Engineering Lab

7:30 pm.

Open Session

Wednesday

9:00-10:00 am.

The West Virginia  
LANDSAT Program  
(M. Luke)

10:00-11:00 am.

Ecological Applications  
of Imagery  
(C. Baer)

11:00-12:00 am.

Ecology Lab

12:00- 1:30 pm.

Lunch

1:30- 3:00 pm.

Forestry Applications  
of Aerial Photography  
(K. Carvell)

3:00- 4:30 pm.

Forestry Lab

7:30 pm.

Open Session

Thursday

9:00-10:15 am.

Imagery and Aerial  
Photograph Applications  
for Soil Surveys  
(Keith Schmuda)

10:30-12:00 am.

Soil Survey Lab

12:00- 1:30 pm.

Lunch

1:30- 2:30 pm.

LANDSAT Inventory of  
Surface Mined Areas  
(A. Anderson)

2:30- 3:30 pm.

Surface Mining Lab

3:30- 4:30 pm.

Film

7:30 pm.

Special Session